



## A further look at the five-dimensional curiosity construct

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### ABSTRACT

The five-dimensional curiosity construct, recently advanced by Kashdan and his colleagues (2018a), was examined using open-ended and Likert type questionnaires to further understand the nomological network and correlates of the five curiosity dimensions. The nature of each dimension (Joyous Exploration, Deprivation Sensitivity, Stress Tolerance, Social curiosity, and Thrill-Seeking) and of profiles based on those dimensions were examined as well as their relationships with value-driven actions (Personal Well-being, Moral values, Religious values, Social Ideology, and Environment.) Results of qualitative and quantitative analyses shed light on the role of positive uncertainty (stress tolerance) and of thrill-seeking in shaping epistemic and social curiosity; on authentic descriptions of reactions to curiosity-related objects or situations; on types of questions of interest that are more likely to be posed by curious people, and on values that drive their actions. The findings were discussed from an educative perspective.

Curiosity, the urge to search for new knowledge and experience, has been long acknowledged as a desirable human characteristic. William James (1890) and later Abraham Maslow (1943) considered it a fundamental psychological motive. Curiosity is associated with openness to experience and to people's opinions and ideas; cognitive flexibility; need for cognition; uncertainty orientation; stress tolerance; risk taking, and self-regulation (Kashdan, Rose, & Fincham, 2004; Lauriola et al. (2015); Mussel, 2010; Spielberger & Starr, 1994).

Numerous studies point to the role of curiosity in facilitating cognitive development (Sternberg, 1994), school and academic learning (von Stumm, Hell & Chamorro-Premuzic, 2011), job performance (Reio & Wiswell, 2000), interpersonal closeness (Kashdan & Roberts, 2004), personal growth (Kashdan et al., 2004), and well-being (Kashdan, Disabato, Goodman, McKnight, & Naughton, 2018). Curiosity has a trait like features yet may be malleable (Kashdan et al., 2004), hence the potential of education to play a major role in its promotion.

Daniel Berlyne proposed two dimensions to distinguish between manifestations of curiosity: Forms of curiosity - Perceptual vs. Epistemic - and inquisitive tendencies - Diverse vs. Specific exploration (Berlyne, 1957). He further asserted that curiosity is induced by the stimulus properties of novelty, complexity, uncertainty, and conflict (Berlyne, 1960, 1967). More recently, Silvia (2005, 2008), pointed out two

necessary conditions for experiencing curiosity, firstly, the person must believe there is sufficient potential for novelty in the situation or object in question; secondly, the person must feel capable of coping with or handling the novelty. Given these assertions, it is no wonder why the cultivation of curiosity is receiving much attention in recent years as it refers to essential skills required to cope with the challenges of life in a fast-changing world full of uncertainties, surprises, and conflicts. Indeed, in his forward to the OECD Learning Framework 2030, Andreas Schleicher, the Director for Education and Skills, places curiosity at the top of the list of required characteristics for life in the 21st century (OECD, 2018).

Competing theories address the emotional experience produced by curiosity. Some researchers associate curiosity with negative emotions and others with positive ones.

Approaching curiosity from a drive reduction theory, Berlyne (1954) asserted that curiosity produces an unpleasant state of uncertainty. Later on, Loewenstein (1994), based on his information-gap model, argued that curiosity stimulates aversive feelings due to awareness of the knowledge gap between the information needed to solve the problem and the available information. These deprivation-related feelings, which are manifested in restlessness (e.g., inability to sleep until the information gap is resolved) (Litman, 2005), arise from

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uncertainty which arouses anxiety and tension (Litman & Jimerson, 2004). In contrast, the theory of acquisition-of-knowledge as reward describes curiosity as a reward of itself or as a positive emotional experience combined with approach motivation (Sansone & Thoman, 2005). Likewise, Kashdan et al. (2004) argue that curiosity is an intense pleasant experience with positive implications for self-esteem and assessment of the world and the future. It can thus be concluded that curiosity consists of a whole family of mechanisms. This conclusion is supported by recent studies in the field of brain research, which suggest that different types of curiosity activate different areas of the brain (Kidd & Hayden, 2015).

Another source of disagreement among curiosity researchers relates to the dimensionality of the construct. Although at present curiosity is no longer conceived as a unidimensional construct, there is still controversy whether two, three or more dimensions should constitute a measure of curiosity and what is the nature of each dimension. For instance, the I-EC and D-EC scales (Litman, 2008) measure two dimensions of epistemic curiosity (Interest (i.e., a drive for new information anticipated to increase pleasant emotions) and Deprivation (i.e., a motive to reduce aversive feelings resulting from lack of needed information)); two somewhat different dimensions (Exploratory experiences and Absorption (i.e., propensity to experience flow states)) are measured by the CEI (Kashdan et al., 2004). Three curiosity dimensions (Cognitive, Social (i.e., seeking social sensations), and physical (i.e., seeking physical sensation)) were identified by Reio, Petrosko, Wiswell, and Thongsukmag (2006). Recently, a five-dimensional curiosity measure (The 5-DC Scale) was advanced by Kashdan, Stikksma, et al. (2018). It comprises two epistemic curiosity scales (Joyous Exploration and Deprivation Sensitivity), a Social Curiosity scale, and two additional scales - Stress Tolerance and Thrill seeking. Although each of these two dimensions was discussed in the curiosity literature before, including them together with the other three dimensions of curiosity in a single measure enables a simultaneous examination of a unified framework of curiosity. The 5-DC Scale was employed in the current study.

Two main purposes of the current study are addressed in the paper: a) Validating the Hebrew version of the 5-DC Scale and the four types of curious people identified by Kashdan, Stikksma, et al. (2018) and b) Deepening understanding regarding the nomological network of curiosity and its correlates, in particular, the role of stress tolerance and thrill-seeking in shaping epistemic and social curiosity. Toward this end, the quantitative measurement was complemented by qualitative evidence and additional variables, including value-driven actions and primary occupation.

## 1. Method

### 1.1. Respondents

The sample consisted of 266 Israeli adults of whom 80.3% were females and 19.7% males between the ages of 18 and 81 (modal age group 41–50). Of the respondents, 88% had an academic degree (31% a first degree, 53% a second degree, and 17% a third degree). The primary occupation of 48% of the respondents was in the area of Education; other occupational areas included economics and finance, business administration, art, music, psychology, medicine, nutrition, sport, technology, tourism, and law. (13% of the respondents skipped the occupation item or used general terms such as *soldier*, *student*, or *retiree*.) It should be noted that our sample was intentionally biased toward the field of education and academic degrees to comply with our multi-stage research agenda, the goal of which is to define theoretically and operationally the construct *Joy of learning*, in which curiosity plays a major role.

The on-line Curiosity Questionnaire (CQ) was administered to a convenience (snowball) sample during May and June 2018. Each of the six authors of the paper sent the link to the questionnaire to at least 15

of her personal and professional acquaintances with a request to fill the questionnaire and to encourage some of their acquaintances to fill it.

The CQ, entitled “Preferences Survey”, was anonymous but the respondents were given an option to provide an email address in order to receive a debriefing document regarding the aims of the study at the completion of the data collection phase and a summary of the findings at the completion of the data analysis phase. The two documents were e-mailed to 39% of the respondents who provided an e-mail address.

### 1.2. Measures

The CQ includes five parts consisting of open-ended and Likert type items:

#### 1.2.1. The curiosity scale

A Hebrew version of Kashdan, Stikksma, et al. (2018) Five-Dimensional Curiosity (5-DC) Scale, which measures Joyous Exploration (JE), Deprivation Sensitivity (DS), Stress Tolerance (ST), Social Curiosity (SC), and Thrill Seeking (TS). Each of the five scales comprises five 7-point Likert-type items from 1 = *Does not describe me at all* to 7 = *Completely describes me*. The 25 items in the Hebrew version are ordered in a cyclical order of the five scales<sup>1</sup>; they appear in the second part of the CQ. Guidelines for translation and adaptation of cross-cultural assessment (Hambleton, 2005; Lenz, Gómez Soler, Dell'Aquila, & Martínez Uribe, 2017) were followed in preparing the Hebrew version of the 5-DC Scale.

#### 1.2.2. Curiosity Related Open-Ended Items

The first part of the CQ comprises the following six completion items that address curiosity-related objects or situations:

- Q1. *One of the topics that interests me the most is ...*
- Q2. *The question that interests me most about this topic is ...*
- Q3. *When I'm solving a problem and having difficulty, I ...*
- Q4. *In situations of uncertainty I ...*
- Q5. *When I meet new people I ...*
- Q6. *“Playing it safe” makes me ...*

The open-ended items are based on the descriptions of the five curiosity dimensions presented in Kashdan, Stikksma, et al. (2018). The items were collaboratively formulated by the research team (the six authors). The initial formulation was tested on a sample of 12 respondents who were asked, following their answers, to rate the extent to which each item was clear, and suggest improvements were required. Based on their responses, the formulation of three items was revised and tested (along with the other items) on a sample of 10 respondents. In this round the formulation of all items was found to be satisfactory.

The open-ended items are preceding the items of the 5-DC Scale to prevent a possible carryover effect that could impact the authenticity of the free responses.

#### 1.2.3. Curiosity type

Kashdan, Stikksma, et al. (2018) identified four types of curious people (*The fascinated*, *problem solvers*, *empathizers*, and *avoiders*) based on a comprehensive battery of personality, cognitive, emotion, and consumer questionnaires. The third part of CQ presents their descriptions of the four types, asking the respondents to indicate the extent to which each description describes them on a 7-point scale from 1 = *Does not describe me at all* to 7 = *Fully describes me*.

#### 1.2.4. Value-driven actions

The fourth part of the CQ comprises five 7-point Likert-type items

<sup>1</sup> (i.e., Scale JE comprises items 1, 6, 11, 16, 21; Scale DS comprises items 2, 7, 12, 17, 22, and so on.)

referring to six values: Personal Well-being (PW), Moral Values (MV), Religious Values (RV), Social Ideology (SI), and Environment (ENV). The respondents are requested to indicate the degree to which each of the values concerns them or drives their actions, where 1 = *Does not concern me at all* and 7 = *Fully concerns me*.

### 1.2.5. Demographic information

The last part of the CQ is designed to collect information regarding gender, age, education, college degree, field of knowledge, primary occupation, and native language.

## 1.3. Analysis

Quantitative and qualitative methods were employed for data analysis. The former included univariate, bivariate, and multivariate statistical techniques (i.e., frequency distributions, crosstabulations, Pearson Product Moment Correlations, Confirmatory Factor Analysis, and Cluster Analysis.). To analyze the open-ended responses Content Analysis (Krippendorff, 2013) was employed. The final codes for each question were mapped into facets with curiosity attributes as their elements. Coding the responses into the attributes was done by the authors; they first coded the same sample of responses and discussed inconsistencies until agreement was reached. Next, each author coded a part of the responses horizontally (per subject) and then vertically (per question) for reliability check. Again, inconsistencies were marked and discussed by the team till agreement was reached. The coded data were then subject to statistical analyses. The elements of each facet were classified into three levels indicating positive, negative, and mixed attributes of curiosity. The number of attributed in each level were counted forming three variables (H/M/L) for each open-ended question. Statistical analyses were then performed to explore the association between the variables derived from the open-ended responses and those derived from the Likert-type scales.

## 2. Findings

The section comprises three parts: the first, focuses on the construct validity of the 5-DC Scale in its Hebrew version. The second part, describes facets and attributes derived from responses to the open-ended questions and examines associations between attributes of high curiosity across facets and scores on the 5-DC Scale. The third part, focuses on curiosity profiles depicting four profile clusters identified in the current study, which are exemplified by responses of four subjects (one per cluster) to the open-ended questions. Also examined are associations between the four profile clusters and Kashdan's four types of curious people (Kashdan, Stikma, et al. (2018)); high curiosity attributes; value-driven actions, and primary occupation.

### 2.1. The five-dimensional curiosity construct

Confirmatory factor analysis (CFA), with Maximum Likelihood as the estimation method, was performed to validate the 5-DC construct of curiosity, as reflected in the data obtained through the Hebrew version of the questionnaire in the current study. Judged upon cut-off criteria ( $\chi^2/df < 3$ ; CFI close to 0.95; SRMR close to 0.08; RAMSEA close to .06) proposed by Hu and Bentler (1999), the CFA of the 5-DC model yielded fit values [ $\chi^2/df < 1.41$ ; CFI = 0.95; SRMR = 0.06; RAMSEA = 0.04, (0.03, 0.05)] indicating satisfactory fit. The loadings of all items on the respective factors were statistically significant ( $\alpha < 0.05$ ) and of at least medium magnitude (0.41–0.76), except for the loadings of item 4 on factor SC (Social Curiosity) and item 22 on factor DS (Deprivation Sensitivity) (0.26 and 0.33, respectively). As to the factor inter-correlations, only the following five bivariate correlations were statistically significant: Factor JE (Joyous Exploration) correlated with factors DS, ST (Stress Tolerance), and TS (Thrill Seeking); factor ST also correlated with factors DS and TS. None of the

correlations between factor SC and the other four curiosity factors were significant. The confirmatory factor model along with factor loadings and significant inter-factor correlations are presented in Appendix A (see Supplementary material).

Scores on the 5-DC Scale were computed along with their reliability coefficients (McDonald's Omega and Cronbach's Alpha),<sup>2</sup> means, standard deviations, and inter-correlations. The results are presented in Table 1.

As shown in the Table, the correlation between Joyous Exploration (JE) and Deprivation Sensitivity (DS) is the highest among the scale inter-correlations. Both scales are also significantly and positively correlated with Thrill Seeking (TS). Scale ST (Stress Tolerance), correlates with scales TS and JE. Only Social Curiosity (SC) fails to significantly correlate with any of the other four scales.

Scale reliabilities (McDonald's Omega coefficients) range between  $\omega = 0.81$  (for scales JE and SC) to  $\omega = 0.73$  (for scale ST). (Cronbach's Alpha coefficients for the same scales range between  $\alpha = 0.74$  to  $\alpha = 0.68$ .) Scale means range between 5.74 and 3.62 on the 7-point scale. Scale JE yielded the highest mean, followed by scales DS and SC. Scales TS and ST yielded significantly lower means.

Comparison between our results and the results reported by Kashdan, Stikma, et al. (2018, p. 135) revealed a similar pattern of scale inter-correlations, except for scale SC, which in our sample had no significant correlations with the other scales whereas in the American samples was significantly correlated with all other scales (correlations ranged between  $r = 0.09$  to  $r = 0.33$ ). In both studies the highest correlation was between scales JE and DS. The internal consistency (reliability) coefficients ( $\alpha$ 's) in the American samples ranged between  $\alpha = 0.8$  to  $\alpha = 0.9$  whereas in our sample they were somewhat lower ( $\alpha$ 's  $\sim 0.7$ ). The means in both studies were similar (none of the differences exceeded half a standard deviation.)

Hence, it can be concluded that the psychometric properties of the Hebrew version of the 5-DC Scale are in fair congruence with those of the original English version.

### 2.2. Curiosity facets and attributes

Responses to open-ended questions 2 to 6 were classified into facets (broad categories) with curiosity-related attributes as their elements. The number of facets per question ranged between 3 and 5 with a mode of three elements per facet. The classification scheme including examples, frequencies, and percentages of responses are presented in Appendix B (see Supplementary material).

As can be seen in the Appendix, subjects varied in their responses to the open-ended questions, resulting in a rich repertoire of cognitive, emotional, and behavioral attributes related to the dimensions of curiosity measured in the 5-DC Scale (Kashdan, Stikma, et al., 2018).

#### 2.2.1. Associations between attribute facets

The number of high-curiosity attributes<sup>3</sup> in each of the five open-

<sup>2</sup> McDonald's Omega ( $\omega$ ) coefficients (McDonald, 1999) are the appropriate reliability coefficients in our case due to the fact that the factor model is not tau equivalent (Revelle & Zimbarb, 2009). Cronbach's Alpha ( $\alpha$ ) coefficients were calculated for comparison with the reliability coefficients reported by Kashdan, Stikma, et al. (2018).

<sup>3</sup> The following attributes were marked as indicating high curiosity in questions 2 to 6:

Q2: Question Type: A2 (Experimental), A3 (Research), A4 (Philosophical/Moral), A5 (Evaluation), A6 (Critical); Question Word: B2 (How?), B3 (Why?); Question Complexity: C2 (Requires information integration/data manipulation), C3 (Complex); Prior knowledge: D2 (q. based on prior knowledge); Innovation: E2 (Non-banal q.); E3 (Creative/innovative q.).

Q3: Competences: A1 (Cognitive and metacognitive); Coping: B1 (Positive coping); Emotions: C1 (Positive emotions).

A4: Competences: A1 (Cognitive and metacognitive); Coping: B1 (Positive

**Table 1**  
Correlations, means, standard deviations, and reliabilities of the five curiosity scales (N = 263).

Scale	No. of items	Correlations <sup>a</sup> (Reliabilities <sup>b</sup> )					Mean	SD
		JE	DS	ST	SC	TS		
JE- Joyous Exploration	5	(0.81) (0.74)	0.47***	0.33***	0.09	0.36***	5.74	0.84
DS- Deprivation Sensitivity	5		(0.76) (0.72)	-0.10	0.04	0.15*	5.22	0.99
ST- Stress Tolerance	5			(0.73) (0.68)	-0.04	0.17**	3.56	1.10
SC- Social Curiosity	5				(0.81) (0.74)	0.11	4.98	1.12
TS- Thrill Seeking	5					(0.80) (0.71)	3.80	1.15

Notes

\* P < .05.

\*\* P < .01.

\*\*\* P < .001.

<sup>a</sup> Pearson correlations among the five-curiosity scales.

<sup>b</sup> McDonald's Omega coefficients (ω) appear above Cronbach's Alpha (α) Coefficients.

ended question (Q2 – Q6) was tallied and Pearson Product Moment Correlations were computed among the five sums yielding the following results: High-level coping with uncertainty (Q4) significantly correlated with high-level coping when meeting new people (Q5) (r = 0.23; P < .01), with high-level coping with difficulty in problem solving (Q3) (r = 0.19; P < .01), and with high-level questions (Q2) (r = 0.15; P < .01). The latter (Q2) also correlated significantly with high-level coping with difficulty (Q3) (r = 0.13; P < .05). None of the correlations with “playing it safe” (Q6) were significant.

2.2.2. Associations between curiosity attributes and 5-CD scale scores

2.2.2.1. Association between curiosity attributes across open-ended questions and the 5-CD scores. Pearson Product Moment Correlations were also computed between the sum of high-curiosity attributes in each open-ended question and the five curiosity scale scores. The correlations are presented in Table 2.

As shown in the Table, high-curiosity attributes characterizing a question of interest (Q2) yielded significant correlations with Scales JE (Joyous Explorations) and ST (Stress Tolerance). Attributes of high-level coping with difficulties in problem solving (Q3) yielded a positive correlation with scale ST (Stress Tolerance) and a negative one with scale TS (Thrill Seeking). Attributes of high-level coping with uncertainty (Q4) and when meeting new people (Q5) yielded each, significant positive correlations with scales JE (Joyous Explorations), ST (Stress Tolerance), and TS (Thrill seeking). Attributes of negative feelings toward “playing it safe” (Q6) yielded positive significant correlations with scales ST (Stress Tolerance), JE (Joyous Explorations), TS (Thrill seeking), and DS (Deprivation sensitivity).

Summarized by scales, ST correlated positively with high-curiosity attributes in all five questions. Scale JE correlated positively with high-curiosity attributes of four questions (Q2, Q4, Q5, and Q6). Scale TS correlated positively with high-curiosity attributes of three questions (Q4, Q5, and Q6) and negatively with high-curiosity attributes of Q3.

2.2.2.2. Attribute comparisons between high and low curiosity groups. To gain further insight regarding the relationships between responses to the open-ended questions and the relevant curiosity scale scores,

(footnote continued)

coping); Emotions: C1 (Positive emotions).

Q5: Orientation: A2 (Socially curious); Coping: B1 (Positive coping); Emotions: C1 (Positive emotions).

Q6: Emotions: A1 (Positive emotions); B1 (Positive reactions/conclusions).

**Table 2**

Correlations between the five curiosity scales and number of attributes of high curiosity in responses to open-ended questions (N = 263).

Curiosity attributes in question	Curiosity scales <sup>a</sup>				
	JE	DS	ST	SC	TS
Q2 – most interesting question	0.15*	0.01	0.14*	-0.06	0.06
Q3 – adequate coping with difficulty in problem solving	0.10	0.09	0.14*	0.06	-0.12*
Q4 – adequate coping with uncertainty	0.22***	0.07	0.21***	-0.05	0.12*
Q5 – adequate coping with meeting new people	0.29***	0.05	0.24***	0.01	0.14*
Q6 – negative impact of “playing it safe”	0.16**	0.11*	0.19**	0.04	0.11*

Notes

\* P < .05.

\*\* P < .01.

\*\*\* P < .001.

<sup>a</sup> JE- Joyous Exploration; DS- Deprivation Sensitivity; ST- Stress Tolerance; SC- Social Curiosity; TS- Thrill Seeking.

proportions of responses to selected attributes were compared between the high and low curiosity groups<sup>4</sup> based on the 5-DC Scale scores.

The results are presented in Table 3.

As shown in the table, the high curiosity groups compared to the low ones on scales DS (Deprivation Sensitivity), ST (Stress Tolerance), and SC (Social Curiosity), expressed significantly higher proportions of positive coping with difficulties during problem solving, of negative coping and negative emotions in situations of uncertainty, of a socially curious orientation toward new people, and of negative emotions toward “playing it safe”, respectively. Likewise, the high curious group on scale JE (Joyous Explorations) compared to the low one, posed significantly more complex questions.

To summarize, the findings reported so far support the construct validity of the 5-DC Scale as measured by its Hebrew version. Moreover, they highlight free-response expressions of cognitive, affective, and

<sup>4</sup> Due to a sizable variation in the scale-score distributions (Skewness values ranging from -0.61 to 0.11 and Kurtosis values ranging from -0.52 to -0.07) the score distribution of each scale was divided into three equal groups (at the 33rd and 66th percentiles), forming relatively low (L), intermediate (M) and high (H) score levels.



**Table 3**  
Comparisons between high and low curiosity score-level groups and attributes on related open-ended questions.

Curiosity scale <sup>a</sup>	O-E Q & attribute	Low C. group		High C. group		Diff.	$\chi^2$
		Proportion	%	Proportion	%		
JE	Q2, C3 <sup>b</sup>	10/35	28.57	25/35	71.42	42.88	12.69***
DS	Q3, B1 <sup>c</sup>	12/38	31.58	26/38	68.42	36.84	10.18**
ST	Q4, B2 <sup>d</sup>	16/17	94.12	1/17	5.88	88.29	25.70***
ST	Q4, C2 <sup>e</sup>	19/23	82.26	4/23	17.39	64.87	18.94***
SC	Q5, A2 <sup>f</sup>	17/46	31.96	29/46	63.04	26.08	6.19*
TS	Q6, A2 <sup>g</sup>	12/35	34.29	23/35	65.71	31.42	6.81**

Notes

- \* P < .05.
- \*\* P < .01.
- \*\*\* P < .001.
- <sup>a</sup> JE- Joyous Exploration; DS- Deprivation Sensitivity; ST- Stress Tolerance; SC- Social Curiosity; TS- Thrill Seeking.
- <sup>b</sup> Complex question.
- <sup>c</sup> Positive coping with difficulties during problem solving.
- <sup>d</sup> Negative coping in situations of uncertainty.
- <sup>e</sup> Negative emotions in situations of uncertainty.
- <sup>f</sup> Socially curios when meeting new people.
- <sup>g</sup> Negative emotions toward “playing it safe”.

behavioral aspects related to each of the five dimensions of curiosity tapped by the 5-DC Scale as well as their intra-relations and their inter-relations with the relevant curiosity scales. Yet, it should be noted that according to Cohen's (1988) cutoff points for effect sizes of Pearson Product Moment Correlations, the magnitude of most correlations was relatively low with only a few reaching a medium magnitude.

2.3. Curiosity profiles

2.3.1. Clusters of curiosity profiles

To explore profiles of response patterns on the five curiosity scales a K-Means Cluster Analysis was performed on the three score-level groups<sup>3</sup> yielding four clusters (profiles) as shown in Table 4.

As can be seen in the table, Cluster 1 was characterized by high score-levels on four scales: Joyous Exploration (JE), Deprivation Sensitivity (DS), Social Curiosity (SC), and Thrill Seeking (TS), and a medium level on Stress Tolerance (ST). Hence, we termed Profile 1 *Multi-directional curiosity*. Cluster 2 was characterized by a low score-level on Social Curiosity and medium levels on the other four scales. We termed profile 2 *Self-oriented curiosity*. Cluster 3 was characterized by a high score-level on Social Curiosity, a low level on Joyous Exploration, and medium levels on the other three scales. We termed Profile 3 *People-oriented curiosity*. Cluster 4 was characterized by high score-levels on Joyous Exploration and Stress Tolerance, and a medium level on

**Table 4**  
Curiosity score-level groups<sup>a</sup> for each curiosity profile.

Profile	N	Curiosity scale <sup>b</sup>				
		JE	DS	ST	SC	TS
1. Multi-directional curiosity	55	H	H	M	H	H
2. Self-oriented curiosity	69	M	M	M	L	M
3. People-oriented curiosity	76	L	M	M	H	M
4. Research-oriented curiosity	63	H	M	H	M	M

Notes

- <sup>a</sup> Score level groups:  
H = high score-level group  
M = Intermediate score-level group.  
L = Low score-level group.
- <sup>b</sup> JE = Joyous Exploration; DS = Deprivation Sensitivity; ST = Stress Tolerance; SC = Social Curiosity; TS = Thrill Seeking.

the other three scales. We termed Profile 4 *Research-oriented curiosity*.

ANOVA F-values for the cluster means on scales JE, DS, ST, SC, and TS were 95.20, 20.44, 43.77, 139.41, and 64.75, respectively; all five values were significant (P < .001).

For illustration purposes, Table 5 presents responses of four subjects (one per cluster) to the open-ended questions (Q2–Q6).

The table's three left columns list the cluster number and its profile (i.e., the score-levels on the 5-DC scales.) The fourth column lists the subject's profile; the next five columns display the subject's verbatim responses to the open-ended questions (Q2–Q6).

As can be seen in the Table, the first subject (id 22), a university student in her twenties, was classified (based on her responses to the 5-DC Scale) to cluster 1 (*Multi-directional curiosity*). In her responses to the open-ended questions she posed a research-oriented question (Q2); expressed an active resourceful approach when coping with difficulties during problem solving (Q3); an optimistic approach when facing uncertain situations (yet not striving for such situations) (Q4); an inquisitive disposition when meeting new people (Q5), and disappointment about missed opportunities when “playing it safe”.

The second subject (id 226), a curriculum developer in his sixties, holding a doctoral degree, was classified to cluster 4 (*Research-oriented curiosity*). He posed a learning-related research question (Q2); expressed an active participatory approach (consulting with friends) to coping with difficulties during problem-solving (Q3); an investigative approach in uncertain situations (Q4); a moderate interest in new people (Q5), and a tendency to avoid “playing it safe” (Q6).

The third subject (id 266), a college professor in her sixties, was classified to cluster 3 (*People-oriented curiosity*). She posed a practice-related question (Q2); reported employing a tedious routine when coping with difficulties in problem-solving (Q3); expressed an attempt to clarify uncertain situations (Q4); elaborated on her interest and curiosity regarding new people and her high communication skills (Q5), and expressed a dual attitude toward “playing it safe”.

The fourth subject (id 147), a musician in her thirties, holding a doctoral degree, was classified to cluster 2 (*Self-oriented curiosity*). She posed a question regarding eternal music, which although not exclusive, is of great relevance and significance to her as a musician (Q2); She further expressed an active approach to coping with difficulties in problem solving (Q2); reported being stressed in situations of uncertainty (Q3); of feeling embarrassed when meeting new people (Q5), and of positive feelings toward “playing it safe”.

It can thus be inferred that the four subjects, whose responses on the open-ended questions were presented above, well exemplify the profile clusters to which they were classified based on their responses on the 5-DC Scale.

2.3.2. Association between curiosity profiles and Kashdan's curiosity types

Four a-priori contrasts were performed to compare the mean response of each profile cluster to the description of the relevant type of curious people as operationalized by Kashdan, Stikma, et al. (2018). For type 1 (The fascinated) the mean of cluster 1 (*Multi-directional curiosity*) was contrasted to the mean of the other three clusters yielding a significant t-value (t = 18.23; P < .001). For type 2 (Problem solvers) the mean of profile cluster 4 (*Research-oriented curiosity*) was contrasted to the mean of the other three clusters yielding a significant t-value (t = 5.24; P < .001). For type 3 (Empathizers) the mean of cluster 3 (*People-oriented curiosity*) was contrasted to the mean of the other three clusters yielding a significant t-value (t = 8.17; P < .001). For type 4 (Avoiders) the mean of cluster 2 (*Self-oriented curiosity*) was contrasted to the mean of the other three clusters yielding a significant t-value (t = 3.23; P < .01). Hence, the results indicate that the four profile clusters are associated with Kashdan's four types of curious people whereby the highest association is between the *Multi-directional curiosity* profile and the Fascinated type whereas the lowest is between the *Self-oriented curiosity* profile and the Avoider type.

**Table 5**  
Responses of four subjects (one per cluster) to the open-ended questions.

Cluster	S <sup>a</sup>	Responses to Open-Ended Questions						
No.	Scale	P <sup>b</sup>	Q2: The question that interests me most about this topic is ...	Q3: When I'm solving a problem and having difficulty, I ...	Q4: In situations of uncertainty I ...	Q5: When I meet new people I ...	Q6: "playing it safe" makes ...	
1 <sup>c</sup>	JE	3	How geographic locations and physical conditions influence cultures?	Consult with friends, search for solutions on the Internet and in books.	Maintain a positive spirit and imagines the possibilities.	Inquire them regarding their background.	Feel that I missed opportunities	
	DS	3						
	ST	2						
	SC	3						
	TS	3						
4 <sup>d</sup>	JE	3	How does the use of digital tools affect learning of young children?	Consult with friends.	Examines various options related to the subject.	Try to get to know them through a short conversation	Not to take this approach	
	DS	2						
	ST	3						
	SC	2						
	TS	2						
3 <sup>e</sup>	JE	1	How to analyze difficult learning material and find a proper way to teach it?	Read the problem again and again. Record the data even if it looks trivial and just a repeat.	Try to get a picture of the situation that will indicate a more reasonable direction.	Am very interested and curious about new people. I have the feeling that I am quickly absorbing their starting point and therefore know how to communicate well with them.	Feel safe. But sometimes it may also be boring.	
	DS	2						
	ST	2						
	SC	3						
	TS	2						
2 <sup>f</sup>	JE	2	What makes music timeless?	Search for information on the subject.	Feel a strong urge to find a practical action that would restore control to me.	Feel embarrassed.	Feel a sense of security.	
	DS	2						
	ST	2						
	SC	1						
	TS	2						

<sup>a</sup> Subject's profile

<sup>b</sup> Profile (Score-levels: 1 = low, 2 = intermediate, 3 = high)

<sup>c</sup> Cluster 1: Multi-directional curiosity

<sup>d</sup> Cluster 4: Research-oriented curiosity

<sup>e</sup> Cluster 3: People-oriented curiosity

<sup>f</sup> Cluster 2: Self-oriented curiosity

2.3.3. Association between curiosity profiles and value-driven actions

To examine associations between value-driven actions and cluster profiles, One-way ANOVAs were performed with each value as the dependent variable and the profile clusters as the independent variable. Four of the five analyses yielded significant F values:

*Environmental values* (F = 7.99, P < .001), with the highest mean for *Research-oriented curiosity* (profile cluster 4) and the lowest for *People-oriented curiosity* (cluster 3). (Means and (SD): 5.24 (1.46) vs. 4.08 (1.37), respectively.) *Social Ideology* (F = 4.46, P < .01), with the highest mean for *Multi-directional curiosity* (cluster 1) and the lowest for *People-oriented curiosity* (cluster 3). (Means and (SD): 5.55 (1.39) vs. 4.70 (1.53), respectively.) *Religious values* (F = 4.55, P < .01), with the highest mean for *Research-oriented curiosity* (cluster 4) and the lowest for *People-oriented Curiosity* (cluster 3). (Means and (SD): 3.57 (1.97) vs. 2.51 (1.56), respectively.) *Moral values* (F = 3.92, P < .01), with the highest mean for *Multi-directional curiosity* (cluster 1) and the lowest for *People-oriented curiosity* (cluster 3). (Means and (SD): 6.27 (1.21) vs. 5.53 (1.27), respectively.) Hence, in all four analyses profile cluster 3 (*People-oriented curiosity*) exhibited the lowest means while profile clusters 4 (*Research-oriented curiosity*) and 1 (*Multi-directional curiosity*) exhibited the highest means.

2.3.4. Association between curiosity profiles and primary occupation

The item regarding primary occupation was answered by 232 respondents (87% of the sample). Crosstabulation of the profile clusters by occupation yielded a significant Chi Square value ( $\chi^2 = 30.44$ ; P < .01). The distribution of the occupations was as follows: 55% education-related occupations (teachers, school principals, supervisors, etc.); 7% therapeutic occupations (psychiatrists, psychologists, nutritionists); 7% finance and business occupations; 6% researchers; 4% art and music occupations, and 21% other occupations (comprising a variety of occupations with low frequencies each (f < 2%) as well as soldiers, students, and retirees). The educators were almost evenly distributed among the four profile clusters (23%, 27%, 22% and 28% in clusters 1 to 4, respectively.) The highest percentages of artists (67%)

and of college professors (39%) were in cluster 2 (*Self-oriented curiosity*). Note that no artists were in clusters 1 or 4. The highest percentage of therapeutics (60%) was in cluster 3 (*People-oriented curiosity*). Of the finance and business persons, 44% were in cluster 3 (*People-oriented curiosity*) and 38% in cluster 4 (*Research-oriented curiosity*).

To summarize, the four curiosity profiles identified in the current study and their associations with action driven-values, primary occupation, and with the four types of curious people as operationalized by Kashdan, Stikma, et al. (2018) lend further (cross cultural) support to the conceptualization of curiosity as a five-dimensional construct and to their typology of curious people.

3. Discussion

The findings of the current study lend support to the multi-faceted conceptualization and operationalization of curiosity proposed by Kashdan, Stikma, et al. (2018) and validate the Hebrew version of the 5-DC Scale and the descriptions of the four types of curious people identified by Kashdan and colleagues (ibid). Further insights regarding the nomological network of curiosity come from analyses of responses to open-ended questions related to each of the five curiosity dimensions and form ratings of five value-driven actions. Joint analyses of the responses to the two assessment modes and integration of the findings shed additional light on the role of positive uncertainty and thrill seeking in shaping epistemic and social curiosity.

It should be noted that although the current study was conducted in a different culture and in a different language from the study by Kashdan and his colleagues, and that aside from the Hebrew version of the 5-DC Scale we used different tools than theirs, and our sample was not a representative sample like theirs, still the curiosity dimensions and the profiles of curious types were satisfactorily replicated.

### 3.1. Insights gained from the findings

#### 3.1.1. Relationships among stress tolerance, thrill seeking, and epistemic curiosity

Curiosity researchers assert that the essential features of a stimulus that can arouse curiosity include novelty, complexity, uncertainty, and conflict (Berlyne, 1960; Kashdan, Stikma, et al., 2018).

Coping successfully with the stress involved in such stimuli requires tolerance of uncertainty and readiness to take risks, not for the sake of risk-taking but for the sake of reaching one's goals (Kashdan, Disabato, et al., 2018).

Gelatt (1989) refers to tolerance of uncertainty as “positive uncertainty”, asserting that it helps to deal with ambiguity, to accept inconsistency, and utilize the intuitive aspect of choosing. Positive uncertainty is thus an essential quality for successful functioning in the 21st century in general, and in complex open systems in particular. Such systems are dynamic, constantly evolving as a result of interactions among agents who self-organize with no directives from authority (Mittleton-Kelly, 2003). Moreover, social complex systems are characterized by paradoxes and contradictions; operating within the range of opposite ends referred to as ‘simultanities’ that co-emerge in harmony (Davis & Sumara, 2010). Hence the importance of fostering positive uncertainty for well-functioning in such systems.

In a recent paper, Kahn and colleagues (2018) who study complex systems, including the healthcare system, assert that transforming such systems to keep sustainable growth and renewal requires that agents at all levels of the system embrace uncertainty.

Likewise, in the educational arena, a conceptualization of assessment culture in school as a complex system depicts a complexivist mindset, which is essential for agents (school leaders and teachers) in such culture to hold, as characterized by positive uncertainty, awareness of limitations, inquisitive orientation, and valued diversity (Birenbaum, 2014).

Moreover, research regarding teachers' stances toward uncertainties reveals that a positive stance, compared to a negative one, is related to increased knowledge, effectiveness, and expertise resulting from constant engagement in a reflective inquiry into their teaching practice (Helsing, 2007).

From a personality perspective, research regarding the relationships between tolerance of uncertainty and personality factors revealed that among the Big Five personality factors (Costa & McCrae, 1988) only Openness to Experience was associated with tolerance of uncertainty (Hodson & Sorrentino, 1999).

In the current study, Profile 4 (*Research-oriented curiosity*) had the highest score on scale ST (Stress Tolerance, which taps uncertainty). This profile combines high scores on scales JE (Joyous Exploration) and ST with only a medium score on scale DS (Deprivation Sensitivity, which refers to being restless until an answer is obtained to an ongoing problem (Litman, 2005)), thus supporting the assertion that epistemic curiosity involves pleasure, i.e., is perceived as a positive emotional event combined with an approach motivation (Kashdan, Disabato, et al., 2018; Sansone & Thoman, 2005). Such a perception is likely to stem from embracing positive uncertainty. The pleasure argument contradicts claims by proponents of the information-gap model (Loewenstein, 1994), that epistemic curiosity elicits distress and discomfort, steaming from the uncertainty induced by the information gap and lasting until the gap is reconciled (Litman & Jimerson, 2004).

Additional support for the pleasure argument comes from studies by Bar-Anan, Wilson, and Gilbert (2009), which confirmed their hypothesis of uncertainty intensification. According to their argument, uncertainty during an emotional event makes unpleasant events more unpleasant and pleasant events more pleasant. This may explain the adherence of researchers characterized by positive uncertainty to immerse in research since the uncertainty involved in any research only reinforces their excitement and pleasure. Indeed, it is not surprising given that research by its very nature involves exploration, leading a

curious researcher to raise questions and doubts, to critically examine previous research inferences, and move forwards with new ideas, thus contributing to scientific progress. Being able to handle the doubts, ambiguities, conflicts, uncertainties, and surprises involved in the exploration process seems to intensify the positive emotions experienced by such researchers.

Thrill seeking is an aspect of sensation seeking (Zuckerman, 1979). It refers to enjoyment of internal arousal produced by risk taking. Research has shown that the four sensation seeking factors of Zuckerman's Sensation Seeking Scale (SSS) (Birenbaum, 1986; Zuckerman, 1979, 2007) are differentially related to personality factors (Birenbaum & Montag, 1986). In particular, an examination of the relationships between thrill seeking, as operationalized by scale TAS (Thrill and Adventure Seeking) of the SSS and Cattell's personality inventory (16PF) revealed that TAS was related to a personality profile of an independent, emotionally adjusted person who tends to be unconventional in his activities (ibid).

Moreover, studies revealed relationships between thrill seeking and epistemic curiosity. For instance, a study by Litman and Spielberger (2003) detected an elevated emotional state among students when they were required to seek innovative information, new ideas, explore in a variety of ways, invent innovative solutions of their own, etc.

Kashdan's TS (Thrill Seeking) scale corresponds to scale TAT (Thrill and Adventure Seeking) of Zuckerman's SSS. In our study, scale TS was associated with the two epistemic curiosity scales (JE and DS), the ST (Stress tolerance) scale, and the open-ended question regarding encountering new people (Q5). Likewise, the responses to the open-ended question regarding “playing it safe” (Q6) (which rests on the assumption that subjects high on thrill seeking would feel uncomfortable in such condition) yielded a similar pattern of relationships consisting of the epistemic curiosity scales (JE and DS), the stress tolerance scale (ST), and the open-ended question about positive uncertainty (Q4).

Support for the relationships between thrill seeking and tolerance of stress and uncertainty comes from research regarding barriers to educational change, which highlights the effect of teachers' perceptions of risk-taking on engagement in new pedagogical processes (Le Feuvre, 2014). While negative perceptions of risk-taking and negative emotions toward uncertainty hinder such engagement, the opposite holds true for positive conceptions and positive uncertainty.

#### 3.1.2. Social curiosity and its relationships with stress tolerance, thrill seeking and epistemic curiosity

Although in our sample scale SC (Social Curiosity) failed to yield significant correlations with the other four scales (unlike in the American samples reported by Kashdan, Stikma, et al., 2018), responses to our open-ended question about meeting new people (Q5) were related to scale ST (Stress Tolerance), to the open-ended question regarding uncertainty (Q4), and to scales TS (Thrill Seeking) and JE (Joyous Explorations). Moreover, Profile 3 (*People-oriented curiosity*) yielded a relatively high correspondence with Kashdan's Type 3 (Empathizers), both depicting socially curious people. Profile 3 was also shown to have the highest percentage of therapeutics in the breakdown of Primary Occupation by Profiles.

However, it should be noted that the open-ended question about meeting new people (Q5) elicited a rich repertoire of responses pointing to varied motives of socially-oriented people. Those include, learning about and from other people; having fun socializing with others; listening to gossip; attempting to make others feel comfortable (caring), etc. It also highlighted ways people handle such situations and the feelings that are aroused. Authentic information of this kind can be utilized for refining the theoretical and operational definitions of social curiosity, discerning it from other related fundamental social behaviors and motives.

#### 3.1.3. Profile 2 (Self-oriented curiosity) and the Avoider type

Comparison of the four curiosity profiles identified in the current



study and the four types of curious people as operationalized by Kashdan, Stikma, et al. (2018), whose descriptions were ranked by our subjects to indicate the extent to which each description resembled them, pointed to links between the two classifications. However, analyses of responses to the open-ended questions by subjects classified to the four profile clusters and a further analysis of the association between the profiles and primary occupation sharpened the distinction between our profile 2 and Kashdan's Type 4 (the Avoider). Based on the findings we infer that the "avoidance" of profile 2 is manifested mainly by avoiding socializing with other people. Moreover, the considerable percentage of artists and college professors classified into Profile 2 cluster lend support to terming it *Self-oriented curiosity*.

### 3.2. Implications of the study

In view of the challenges facing life in the 21 century in general and in the workplace in particular, understanding curiosity and fostering it seem essential for well-being and for professional growth. Hence, the findings of the current study, which corroborate earlier findings in other cultures, have implications for organizations, particularly for schools.

Curiosity is considered an essential characteristic for employees in today's workplace (Kashdan, Disabato, et al., 2018). It is thus important that organizations' leaders address it in selecting employees, in designing organizational learning programs, and in their own practice (Senge, 1990).

In school systems, curiosity plays multiple roles: It is a desirable characteristic of staff members (principals and teachers), an attribute of good leadership (Sergiovanni, 1995) that invests major efforts in promoting an assessment culture in school (Birenbaum, 2014, 2016), a main characteristic of successful professional learning communities (McLaughlin & Talbert, 2006) and of appropriate assessment for learning (AfL) practice (Ruiz-Primo, 2011; Wiliam, 2011). Furthermore, fostering students' curiosity is considered a main educational target (OECD, 2018). It should be noted that since curiosity is considered "contagious" (Gordon, Breazeal, & Engel, 2015), once teachers' curiosity has been fostered in teacher preparation and in professional development programs it would pave the way to cultivating students' curiosity.

### 3.3. Limitations of the study

As mentioned in Section 1.1, our sample was not a representative one like the American samples studied by Kashdan, Stikma, et al. (2018). It was biased toward the field of education, toward academic degrees, and gender-wise, toward females. This could explain the somewhat lower magnitude of correlations in our study, due to a restriction of the range effect. The sample bias could also explain the relatively weak correspondence between the Avoider (non-curious) type, as operationalized by Kashdan and colleagues (ibid), and our profile 2 (*Self-oriented curiosity*). The Avoider type is described as the least educated type, having the least amount of passions, skills, knowledge, and expertise in various domains. In contrast, the avoidance characteristic of our profile 2 refers mainly to social relations.

### 3.4. Further research directions

In view of the limitations mentioned in the previous section, we recommend to replicate the study in a larger and a more representative sample of Israeli adults. Such a sample would enable a more thorough investigation of the construct validity of the translated 5-DC Scale including tests of factorial invariance involving relevant groups (e.g. Hebrew-English bilinguals). It would also enable to explore whether the relatively weak correspondence between the Avoider (non-curious) type and the *Self-oriented curiosity* profile is a consequence of the biased sample and whether both profiles will emerge in a heterogenic sample

of Israeli adults.

We further recommend to measure the five dimensions of curiosity in preschool, elementary school, junior high school, and high school in order to assess trajectories of curiosity along education levels and to interview focus groups of students and their teachers for the purpose of identifying factors that affect those trajectories. This would enable to design tailored interventions to promote curiosity in the various levels of education.

Given the wide range of social themes elicited by our open-ended question tapping social curiosity, which points to the need for refinement of the social curiosity construct and its measurement, we also recommend to explore the nomological network of social curiosity. Such exploration could address the following facets: Motives for acquiring the information on other people; means for gathering the information; related concepts and personality traits; factors inhibiting interest in other people, and outcomes of being socially curious.

Finally, we recommend to conduct an international comparative study to examine cultural influences on levels and patterns of curiosity among citizens of different countries. Contrasting effects of various cultural contexts on dimensions of curiosity could provide much-needed insight regarding the nomological network of curiosity from a global perspective.

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